

CLAIMS

1. Procedure for determining the risk of flammability of a mixture of at least two reactive
5 gases A, B, in an inert or base gas, or the order of mixing of these reactive gases into the inert or base gas, characterized in that it comprises:

- a step for determining whether the composition of the mixture, during its formation, passes through
10 the flammability region in the ternary diagram of the A/B/inert or base gas mixture when this mixture is produced according to a first mode in which A is firstly mixed into the inert or base gas in order to form a first mixture and then B is mixed into the first
15 mixture in order to form the final mixture.

2. Procedure according to Claim 1, which furthermore includes:

- a step of determining a first transit time through the flammability region of the said ternary
20 diagram when this mixture is produced according to the first mode; .

- a step of comparing this first transit time with the chemical induction time of the mixture or of the stoichiometric mixture.

25 3. Procedure according to Claim 1, which furthermore includes a step of comparing one or more mixing times of the mixer or mixers used with the chemical induction time of the mixture or of the stoichiometric mixture.

30 4. Procedure according to one of Claims 1 to 3, which furthermore includes, if the composition of the mixture passes through the flammability region of the said ternary diagram, or else if the first transit time or the mixing time is greater than the chemical
35 induction time of the mixture:

- a step for determining whether the composition of the mixture, during its formation, passes through the flammability region in the ternary diagram of the A/B/inert or base gas mixture, when the latter is

produced according to a second mode in which B is firstly mixed into the inert or base gas in order to form a first mixture and then A is mixed into the first mixture in order to form the final mixture.

5 5. Procedure according to Claim 4, which furthermore includes:

 - a step of determining a second transit time through the flammability region of the said ternary diagram when this mixture is produced according to the
10 second mode;

 - a step of comparing this second transit time with the chemical induction time of the mixture or of the stoichiometric mixture.

 6. Procedure according to Claim 4, which
15 furthermore includes a step of comparing one or more mixing times of the mixer(s) used with the chemical induction time of the mixture or of the stoichiometric mixture.

 7. Procedure according to one of Claims 1 to 6,
20 which comprises, if the composition of one of the mixtures according to one of the modes of injection does not pass through the flammability region during its formation, the selection of this mode.

 8. Procedure according to one of Claims 2 or 3
25 or 5 or 6, which comprises the selection of a mode or of the mode for which the mixing time or times or the transit time through the flammability region of the said ternary diagram is less than the chemical induction time of the mixture.

30 9. Procedure according to one of Claims 1 to 6, which comprises, if the two modes of injection both force the composition to pass through the flammability region, the selection of the mode for which:

 (i) the intermediate mixture point,
35 representative of the composition of the first mixture, lies outside the flammability region;

 (ii) the mixing time or times or the transit time through the flammability region of the ternary diagram

is less than the chemical induction time of the mixture.

10. Procedure for producing a mixture of at least two reactive gases A, B in an inert or base gas, which
5 comprises:

- determining the flammability risk of the mixture, while the mixture is being produced, or determining the order of mixing of these reactive gases into the inert or base gas, according to one of Claims
10 1 to 9;
- mixing the reactive gases A and B in the order for which the composition of the mixture does not pass through the flammability region while the composition is changing, or for which the mixing time(s) or the
15 transit time through the flammability region of the ternary diagram is (are) less than the chemical induction time of the mixture.

11. Procedure for producing a final mixture of at least two reactive gases A, B in an inert or base gas,
20 characterized in that it comprises:

- mixing the gas A in the inert or base gas, in order to form a first mixture, the composition of which changes, during its formation, outside the flammability
25 region of the ternary diagram of the A/B/inert gas mixture, or passes through the flammability region with one or more mixing times of the mixer(s) used, or a transit time through the flammability region, less than the chemical induction time of the first mixture;
- mixing the gas B into the first mixture,
30 forming a mixture whose composition changes towards that of the final mixture, the composition of this mixture changing, in the said ternary diagram, either without passing through the flammability region or by passing through the flammability region, with one or
35 more mixing times of the mixer(s) used, or a transit time through the flammability region, less than the chemical induction time of the mixture.

12. Procedure according to one of Claims 1 to 11, which includes a prior step of determining the mixing

time or times of one or more mixers intended to be used for mixing reactive gases and for determining the temperature at which the spontaneous ignition time of the mixture becomes equal or substantially equal to one
5 of the mixing times.

13. Procedure according to one of Claims 1 to 12, the mixing being carried out at a temperature of between 300°C and 600°C.

14. Procedure according to one of Claims 1 to 13,
10 the mixing of the two reactive gases A, B into an inert or base gas being that of a recycle process.

15. Procedure according to one of Claims 1 to 13, the mixture of the reactive gases being a mixture of oxygen and butane in an inert gas.

15 16. Procedure according to one of Claims 1 to 13, the mixture of the reactive gases being a mixture of oxygen and ethylene in an inert gas.

17. Procedure according to one of Claims 1 to 13, the reactive gases to be mixed into the inert or base
20 gas being at least three in number and the order of mixing of the gases being determined by considering the pairs of gases that can be mixed successively, and the corresponding ternary diagrams.

18. Procedure according to one of Claims 1 to 17,
25 which includes a step of consulting an electronic database containing data on ternary diagrams and/or consulting an electronic database containing data on induction times of gas mixtures and/or consulting an electronic database containing data on mixing times of
30 mixers.

19. Procedure according to one of Claims 1 to 18, which furthermore includes a graphical representation, on a display screen, of the ternary diagram(s) in question and of the corresponding flammability region
35 or regions in this diagram or these diagrams.

20. Procedure for producing a plant for mixing at least two reactive gases A, B into a base gas, comprising the following steps:

- the order of mixing these gases is determined according to one of Claims 1 to 19;

- a plant is produced so as to mix the gases in the order thus determined.

5 21. Apparatus for establishing the flammability risk of gas mixtures, each mixture comprising at least two reactive gases A, B, in an inert or base gas, or for determining the order of mixing of these reactive gases into the inert or base gas, characterized in that
10 it comprises:

- means (52) for storing at least one database (54) containing, for gas mixtures, data on the ternary diagrams of these mixtures, and the flammability regions in these diagrams for given temperature and
15 pressure conditions;

- means (80) for selecting a gas mixture and temperature and pressure conditions to be used for this gas mixture;

- means (79) for displaying a ternary diagram and
20 the flammability region of a mixture in this diagram.

22. Apparatus according to Claim 21, which furthermore includes means (72, 74) for computing, or especially programmed means for computing or establishing, for gas mixtures each containing at least
25 two reactive gases A, B in an inert or base gas, and for temperature and pressure conditions for these mixtures, a flammability region in the ternary diagram of the mixture.

23. Apparatus according to Claim 21 or 22, which
30 includes means (72, 74) for computing, or means especially programmed for computing or establishing, for gas mixtures each containing at least two reactive gases A, B in an inert or base gas, and for temperature and pressure conditions of these gases, a transit time
35 for this mixture to pass through the flammability region of the corresponding ternary diagram.

24. Apparatus according to one of Claims 21 to 23, which includes means (52) for storing at least one database (55) containing, for gas mixtures, data on the

induction times, or ignition times, of these mixtures according to the temperature and pressure conditions.

25. Apparatus according to one of Claims 21 to 24, which includes means (22, 24) for computing, or
5 especially means programmed for computing or establishing, for gas mixtures each containing at least two reactive gases A, B in an inert or base gas, and according to temperature and pressure conditions of these mixtures, chemical induction times of these
10 mixtures.

26. Apparatus according to one of Claims 21 to 25, which furthermore includes a database (56) containing information on mixing times of mixers, and means (80) for selecting a mixer.

15 27. Apparatus according to one of Claims 21 to 26, which furthermore includes means (72, 74) for, or means especially programmed for, comparing a mixing time or a transit time through a flammability region of one of the ternary diagrams, and a chemical induction
20 time of this mixture.

28. Apparatus for establishing the flammability risk of mixtures, each mixture consisting of at least two reactive gases A, B in an inert or base gas, or for establishing the order of mixing of these reactive
25 gases into the inert or base gas, characterized in that it includes means for computing, or means especially programmed for computing, as a function of temperature and pressure conditions:

- the ternary diagram of a mixture and the
30 flammability region in this diagram;

- a chemical induction time of these mixtures.

29. Apparatus according to Claim 28, which furthermore includes means (79) for displaying a ternary diagram and the flammability region of a
35 mixture in this diagram.

30. Apparatus according to either of Claims 28 and 29, which furthermore includes means for computing a mixing time of a given mixer or for storing mixing times of a set of mixers.

31. Terminal (58) for establishing the flammability risk of a mixture of at least two reactive gases A, B in an inert or base gas, or the order of injecting these reactive gases into the inert or base gas, characterized in that it comprises:

5 - communication means (62, 64, 66, 81) for communicating between the said terminal and means (52) containing at least one database (54, 55, 56, 57) which includes, for gas mixtures, data on the ternary
10 diagrams of these mixtures, and the flammability regions in these diagrams as a function of the temperature and pressure conditions;

 - means (80) for supplying the said terminal with data for the user of the said terminal, including at
15 least one gas mixture used, and the temperature and pressure conditions of use;

 - storage means (74, 76), communicating with the means for supplying the said terminal with the user data, to store this user data, as well as data supplied
20 by the database on the ternary diagram of the mixture selected;

 - display means (79), communicating with the storage means, for presenting, in the form of a graph, at least the ternary diagram supplied by the database.

25 32. Computer program comprising the instructions for executing a procedure according to one of Claims 1 to 19.

 33. Data medium, which can be read by a computing system, comprising the data, in coded form, for
30 executing a procedure according to one of Claims 1 to 19.

 34. Software product comprising a program data medium means, capable of being read by a computing system, allowing a procedure according to one of
35 Claims 1 to 19 to be executed.